Alg. 2 Warm Up # 9-5

Where are the following functions undefined?

1. $f(x) = \dfrac{2}{x^2 + 6x + 8}$

2. $f(x) = \dfrac{x - 4}{x^2 - 7x + 12}$

3. $f(x) = \dfrac{x + 2}{x^2 + 6x + 8}$

4. How are the graphs of # 1 & 3 different where they are undefined?

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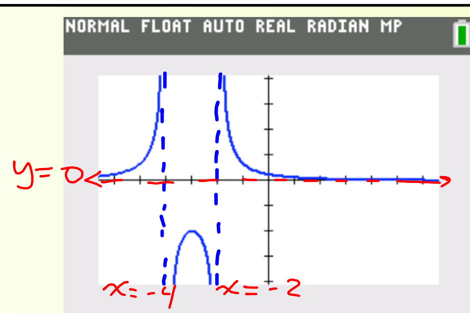
1. $f(x) = \dfrac{2}{x^2 + 6x + 8}$

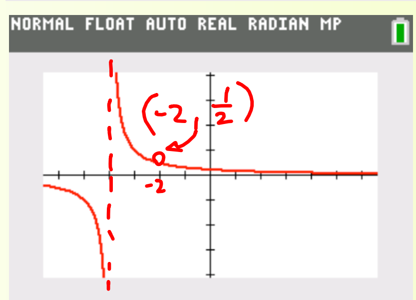
$(x+2)(x+4)$



3. $f(x) = \dfrac{\cancel{(x + 2)}}{x^2 + 6x + 8}$

$\cancel{(x+2)}(x+4)$

$\boxed{y = \dfrac{1}{x+4}}$

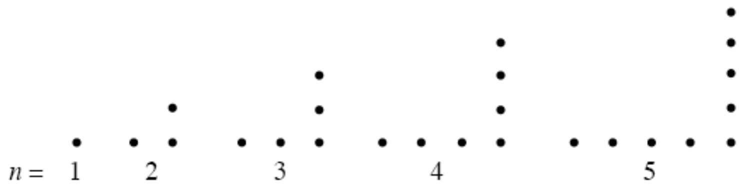


Looks the same except doesn't have the hole at $x = -2$, so we can use it to find the y-value of the hole.

HW Questions:

Review & Preview

3-63. Given that n is the length of the bottom edge of the backward L-shaped figures below, what sequence is generated by the total number of dots in each figure? What is the 46th term, or $t(46)$, of this sequence? The n^{th} term?



n	1	2	3
$t(n)$	1	3	5

-2 $+2$ $+2$

$t(n) = 2n - 1$

3-64. A piece of metal at 20°C is warmed at a steady rate of 2 degrees per minute. At the same time, another piece of metal at 240°C is cooled at a steady rate of 3 degrees per minute. After how many minutes is the temperature of each piece of metal the same? Explain how you found your answer.

Start 20°C

$\frac{2°C}{min}$ $\frac{\Delta y}{\Delta x}$

rate is constant so linear relationship.

let x = time in min

y = Temp in °C

$y = 2x + 20$

cooling so negative

$y = -3x + 240$

use = values method to solve for x

3-65. The price of a movie ticket averages \$10.25 and is increasing by 3% per year. Use that information to complete parts (a) through (c) below.

100% + 3%

a. What is the multiplier in this situation? 1.03

b. Write a function that represents the cost of a movie ticket n years from now.

c. If tickets continue to increase at the same rate, what will they cost 10 years from now?

3-66. Use the meaning of an exponent to rewrite the expression $(y-2)^3$.

$(y-2)(y-2)(y-2)$

3-67. This problem is a checkpoint for rewriting and simplifying expressions with integral and rational exponents. It will be referred to as Checkpoint 3A.

For parts (a) through (d), rewrite each expression. For parts (e) through (h), simplify each expression.

a. $\sqrt[5]{x}$ b. $\frac{1}{x^3}$ c. $x^{2/3}$ d. $\frac{1}{\sqrt{x}}$

e. $x^{-1}y^{-8}$ f. $(m^2)^{-3/2}$ g. $(x^3y^6)^{1/2}$ h. $(9x^3y^6)^{-2}$

square root

$x^{3(\frac{1}{2})}y^{6(\frac{1}{2})}$

$x^{3/2}y^3$

$\left(\frac{1}{9x^3y^6}\right)^2$

$\frac{1}{81x^6y^{12}}$

3-68. While David was solving the equation $100x + 300 = 500$, he wondered if he could first change the equation to $x + 3 = 5$. What do you think?

a. Solve both equations and verify that they have the same solution.

b. What could you do to the equation $100x + 300 = 500$ to change it into $x + 3 = 5$?

3-69. Multiply the expressions below using generic rectangles.

a. $(5m - 1)(m + 2)$

b. $(6 - x)(2 + x)$

c. $(5x - y)^2$

d. $3x(2x - 5y + 4)$

$3x$	$6x^2$	$-15xy$	$12x$
	$2x$	$-5y$	4

$6x^2 - 15xy + 12x$

3-61. CLOSED SETS from Salmon CP's:

Whole numbers (positive integers and zero) are said to be a **closed set** under addition: if you add two whole numbers, you always get a whole number. Whole numbers are not a closed set under subtraction: if you subtract two whole numbers, you do not always get a whole number. For example, $2 - 5 = -3$ and -3 is not a whole number.

a. Investigate with your team whether the set of integers is a closed set under addition and under subtraction. Then investigate whether the integers are a closed set under multiplication and under division. Give examples. If you think the set is closed, explain why. If, not, give counterexamples.

b. Are single-variable polynomials closed under addition, subtraction, and multiplication? In other words, if you add, subtract, or multiply two polynomials that have the same variable, will you always get a polynomial as your answer? If you think the set is closed, explain why. If, not, give counterexamples.

Remember: A polynomial is $\left(\text{Any Real Number}\right) X^{\left(\text{Whole Number}\right)}$

Like: $4x^3$ or $3x-1$

Is 7 a polynomial? yes $7x^0 = 7$

How about zero? 0

$4x^3 + 3x - 1$ ✓

$4x^3 - 3x + 1$ ✓

$4x^3(3x-1)$

$12x^4 - 4x^3$ ✓

$0^0 = ?$

$2 \cdot ☺^4 = ☺$

Week 9 Classwork:
Warm up
3- # 1 --->3
Pink (#13 - 21)
Purple (# 37 - 38)
Salmon (#57 - 61)

CP's: 3- #70 ---> 76

3.2.2 How can "1" be useful?

Simplifying Rational Expressions

In this chapter, you will focus on an important number: the number 1. What is special about 1? What can you do with the number 1 that you cannot do with any other number? You will use your understanding of the number 1 to simplify algebraic fractions, which are also known as **rational expressions**.

3-70. What do you know about the number 1? With your team, brainstorm ideas and be ready to report your ideas to the class. Create examples to help show what you mean.

3-71. Mr. Wonder claims that anything divided by itself equals 1 (as long as you do not divide by zero).

a. Mr. Wonder states that $\frac{16x}{16x}=1$ if x is not zero. What is his hypothesis and his conclusion?

If $x \neq 0$, then $\frac{16x}{16x} = 1$

b. Is Mr. Wonder correct? That is, is his statement true? Justify your conclusion.

$\cancel{(16x)}\frac{16x}{\cancel{16x}} = 1(16x)$

$\checkmark\ 16x = 16x$

c. Why can't x be zero? Can't ÷ by 0

d. Next he considers $\frac{x-3}{x-3}$. Does this equal 1? What value of x must be excluded in this fraction?

yes as long as $x \neq 3$

e. Create your own rational expression (algebraic fraction) that equals 1.

$\frac{z+20}{z+20}$

f. Mr. Wonder also says that when you multiply any number by 1, the number stays the same. For example, he says that the product below equals $\frac{x}{y}$. Is he correct?

$$\frac{z}{z} \cdot \frac{x}{y} = \frac{x}{y}$$

$$\frac{z}{z} \cdot \frac{x}{y} = \frac{x}{y} \checkmark$$

3-72. Use a calculator to graph the function $f(x)=\frac{16x}{16x}$. Use the trace button to trace along the line and notice what happens at $x=0$. Is the expression $\frac{16x}{16x}$ equivalent to 1? Explain.

there is a hole there!

3-73. With your team, compare and contrast the graphs of each of the following functions:

$$f_1(x)=\frac{2x-3}{2x-3} \qquad f_2(x)=\frac{2x-3}{3-2x}$$

$$f_3(x)=\frac{2x-3}{2x+3} \qquad f_4(x)=\frac{1}{2x-3}$$

a. First visualize and make a quick sketch of what you imagine the graph of each will look like.

b. Discuss your sketches with the rest of your team.

c. Use calculators to graph each rational function, and adjust your sketches if needed.

d. Use the $\boxed{\text{TRACE}}$ function or the table on your graphing calculator to find the location of the "hole" in each of the graphs, and describe their similarities and differences. Include their domains and ranges in the descriptions.

3-74. Use what you know about the number 1 to simplify each expression below, if possible. State any value(s) of the variable that would make the denominator zero.

a. $\frac{x^2}{x^2}$ b. $\frac{x}{x} \cdot \frac{x}{x} \cdot \frac{x}{3}$ c. $\frac{x-2}{x-2} \cdot \frac{x+5}{x-1}$ d. $\frac{9}{x} \cdot \frac{x}{9}$

e. $\frac{h \cdot h \cdot k}{h}$ f. $\frac{(2m-5)(m+6)}{(m+6)(3m+1)}$ g. $\frac{6(n-2)^2}{3(n-2)}$ h. $\frac{3-2x}{(4x-1)(3-2x)}$

3-75. Mr. Wonder now tries to simplify $\frac{4x}{x}$ and $\frac{4+x}{x}$.

a. Mr. Wonder thinks that since $\frac{x}{x} = 1$, then $\frac{4x}{x} = 4$. Is he correct? Substitute three values of x to justify your answer.

b. He also wonders if $\frac{4+x}{x} = 5$. Is this simplification correct? Substitute three values of x or use your calculator to compare the graphs of $g(x) = \frac{4+x}{x}$ with $h(x) = 5$ to justify your answer. Remember that $\frac{4+x}{x}$ is the same as $(4+x) \div x$.

c. Compare the results of parts (a) and (b). When can a rational expression be simplified in this manner?

d. Which of the following expressions below is simplified correctly? Explain how you know.

i. $\frac{x^2+x+3}{x+3} = x^2$ *ii.* $\frac{(x+2)(x+3)}{x+3} = x+2$

3-76. In problem 3-75, you may have noticed that *both* the numerator and denominator of an algebraic fraction must be written as a product before you can use any of the terms to create a **Giant One** (a form of the number 1). Examine the expressions below. Factor the numerator and denominator of each fraction, if necessary. That is, rewrite each one as a product. Then look for "Giant Ones" and simplify. For each expression, assume the denominator is not zero.

a. $\frac{x^2+6x+9}{x^2-9}$ b. $\frac{2x^2-x-10}{3x^2+7x+2}$ c. $\frac{28x^2-x-15}{28x^2-x-15}$ d. $\frac{x^2+4x}{2x+8}$

HW: 3 -

78 ---> 84